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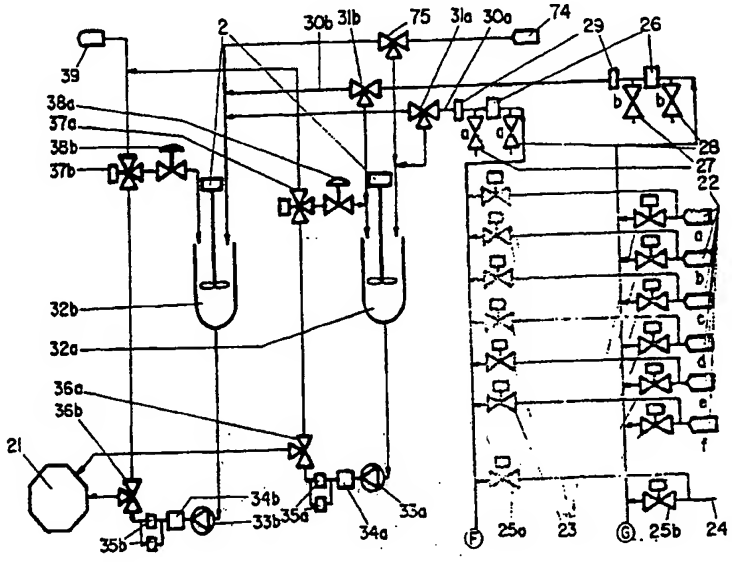

(57) Abstract

Continuous and automatic process for the production of paint including tanks of raw materials, for the addition of rosins (A), of concentrates (B), of additives (C) and of solvents (D). For the production of paints, the process of balanced mixture of raw materials may be divided into two feeding lines (F, G) which receive the introduction of raw materials automatically dosed, by valves and pumps, in mixing tanks (32a, 32b), with a lower outlet pipe which directs the mixture toward the main mixer (21). The paint is taken to a storage tank (41), with a portion of the paint going to a control cell, and with the data being compared with the data of the standard paint for adjustment of color, coverage, and viscosity. An internal cleaning system uses nitrogen to push the paint out from the pipes which are then cleaned with pumped solvent.

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PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS

This descriptive report for patent of invention relates to a Continuous and Automatic Process for the Production of Automotive and other Paints, the development of which has as purpose to obtain a process which assures color uniformity, texture and viscosity in the production of paints specially destined to the painting of metal objects, specially car bodies.

Presently, the manufacture of paint by the conventional method involves a quite complex process and is formed by the following phases: weighing of the raw material. preparation, adjustment of color, coverage. adjustment of viscosity, quality control, canning and packaging. The raw materials which are necessary to produce a given color of paint are weighed in the quantities mentioned in a formula, placed on a pallet and taken, by the lifting truck, to the plaint manufacturing plant which is awaiting the starting of the production. As it is noticed, the raw materials, either solid or liquid, are weighed in different places, far from the production line, and we should point out that the accuracy of such weighed quantities depends upon the scales used which, on their turn, should constantly gauged so that precise results may be achieved in the weighing operations. Some raw material, which are added in large quantities (such as rosins and solvents), are taken at the plant preparation area.

All raw materials which arrive at the preparation area are kept in tanks located in dikes. Each tank has its own pump which is driven by the respective feeding valve for raw materials and which is located in the piping which reach the plant, and in said piping system there is coupled a single flow meter which controls the quantity of the raw materials which have to be added to the mixing tank.

Initially, the operator connects one end of a hose to the pipe of the product which is to be added while the other end of the hose is placed against the mouth of the mixing tank, in such a way that in order to unload the raw material, the operator marks in the meter the quantity in weight (Kg) of the product and open the feeding valve; said valve send an electric signal to the pump (located in the dike) turning it on and transferring the product from the outside storage tank to the mixing tank, located at the plant and, in this manner, as soon as the quantity marked in the flow meter is reached the pump is automatically turned off.

The preparation phase consists of the addition, one by one, of the raw materials, following a given order and starting always with the products of large quantity, followed by those of small quantity, with the rosin being the first product to be added in the mixing tan, without stirring. It should be noted that if the rosin is stored in drums, the operator should use a drum tumbler, which is kept in an appropriate place, taking it next to the mixing tank in order to proceed with the unloading of the rosin and, if said rosin is taken directly from the pipe system existing in the plant, the procedure is practically the same for the weighing or, if there is a pipe system feeding the plant, the addition process is through the flow meter, as mentioned above.

Other products (additives) are added also by hand and under stirring, using pails and cans.

The whole addition work described above takes approximately 4 hours.

The dying or color adjustment process is performed by the manual addition, with use of pails, of the dying additives, with the color technician weighing first the empty pails where the dyes are placed and weighing the pails again when full, in order to identify the volume of concentrate materials which are placed in the tank under stirring, until reaching the appropriate color, with the pails being weighted once again in order to define the exact quantity which was added.

Then a small sample of the paint is taken to the quality control laboratory, which paints a small plate at the painting cabin, with said plate being dried, in open air, for 5 to 30 minutes, and than in a stove, under 60 to 180° C temperature for 10 to 30 minutes, waiting the cooling down of the plate and comparing it with a standard sample, either visually or through instruments. If the color is not within the required standards, the color technician makes the necessary adjustments and repeats the procedure in order to adjust the color until the paint is within the referred standards. Normally, in order to adjust the color, the color technician repeats from 3 to 4 times the above mentioned process an this takes, in the average, 4 hours. It should be pointed out that if the color technician adds the wrong dye or in an exaggerated amount, it is impossible to adjust the color and, therefore, the whole lot is lost.

After the adjustment of the color a sample is taken and sent to the quality control department for the adjustment of viscosity and tests. The viscosity adjustment is made on the sample and performed through the identification of the volume of solvent contained in said sample, when the total volume of solvent to be added to the mixing tank is computed.

In this phase, the operator should bring the solvent to adjust the viscosity, weighing the solvent in pails, cans or drums (depending upon the quantity of solvent to be added) and pouring it into the mixing tank. If the use of drums is necessary, a drum tumbler equipment should be used, which is kept in an appropriate place, taking it next to the mixing tank in order to proceed with the unloading of the solvent.

In order to wash the tank or bowl, the operator fills a can with cleaning solvent, taken from the closest solvent pipe, pour it by hand and cleans the walls with a brush. After this starting work, the operator pours more solvent in order to rinse, and this dirty solvent, which comes from the tank or bowl, is drained through a draining cock into a drum, which is taken to the shipping platform of the plant in order to be removed to the so called "solvent recuperating" plant, which distillates and recovers the solvent, which will be returned to the plant through a pipe system, to be used again.

When the paint is ready, a sample is taken and sent to the quality control department, where the following tests are performed: color, coverage, solids, specific weight and viscosity.

Presently, these tests are performed as follows:

Color: is the determination of differences in shade between a film and its respective standard, when looked under natural light and in which a sample is taken out, the viscosity is adjusted and the pain is applied on a steel plate, awaiting for 15 minutes to evaporate the light solvents and, after said period of time, the sample is placed on a stove under 60°C for 30 minutes. The average time for the test is of 1 (one) hour, but in the case of white synthetic enamel, the color technician needs 16 hours for the drying of the paint in open air, and it may take up to 5 days in order to adjust the color and to finish the tests.

Specific weigh: used for the determination of the specific mass of liquid paints, solutions and dispersions, the result of which is expressed in g/cm^3, being traditionally referred to as density; the method is based upon the relationship between mass of a substance and its volume. For this, a container, the volume of which is known, is filled with a sample at 25°C, the container is weighed obtaining the specific weight, with the average time spent to perform the test being approximately 10 minutes.

Solids: is the percentage of solid material existing in a paint. The content of non volatile material in a product is not an absolute quantity, but depends

uponthe temperature and time of heating used; the recommended temperature and time is 120°C + 2°C for 1 hour of stove, and, in this method a fixed quantity of the product is weighed, spread in a container and taken to a stove for 1 hour, after said period, the sample goes to the drying oven for 30 minutes and then is weighed in a laboratory scale in order to obtain the percentage of solid material; the average time for said tests is 2 hours. If the percentile value of solids is out of the specified standards, the adjustment is made with the addition of rosin or dyes and if during said addition a larger quantity is used, the whole lot is rejected.

Viscosity: in a quite empirical way, it is possible to say that viscosity is the difficulty a liquid offers against its flowing; the method is based upon the flowing time of a continuous flow of a liquid at 25°C, through a given diameter hole called Ford 4 glass, and if the solvent is added in large quantities, it is also impossible to adjust the viscosity, therefore losing the whole lot.

Said test takes approximately 30 minutes to be performed.

After the liberation by the Quality Control department, the approved paint is placed in cans and then packaged, by had. The filling of containers may be performed in any quantity, depending on the machine to be used.

The average time needed to achieve the analysis for color, viscosity, solids and specific weight, considering the total time from the moment taken from the

production sector, time awaiting for the tests in the laboratory, until the final answer from the Quality Control Laboratory to the production department is of approximately 4 hours.

We should point out further that if the addition of dyes, solvents or rosins for the adjustment of color, viscosity and solids are performed in non appropriate quantities by the operator or color technician, it is possible to lose the whole lot, which will be totally eliminated.

made by different persons and, considering that there are the aspects of training, capacity, interpretation of results, the analysis depend also of the gouging of the instruments and quality of the laboratory equipment. Finally, there is a series of factors which may affect significantly the results, with implications in quality and in the cost of production.

In the patent nor applied for, the continuous and automatic process for the production of automotive paints and others is constituted by a process which produces automatically any type of paint, strictly within the standards specified in the formulae, complying with the requirements of color, coverage, solids and viscosity, allowing also the automatic change of color or type of paint in approximately 3 minutes. The packaging may be made with any volume, depending of the machine to be used for such a work.

For the manufacture of certain types of paint, the mixture of materials is taken into one of the two mixing tanks; while a mixing tank is loaded and mixing,

the mixture of the other tank is being continuously pumped into the head of the mixer, which has high speed stirring. Other materials required for the final paint (additives and dyes) shall be simultaneously pumped within the mixing head in order to be mixed with products of different tanks of raw material. We call raw materials the rosins, the concentrates, solvents and additives which are used for the production of paints.

The paint, after ready, passes through a probe which reads the color and viscosity and then is loaded into cans or drums (0.9, 1.0, 3.6 and 4.0 litters or other volumes) ready for delivery.

The whole manufacture process for paint is performed by the PLC (Programmable Logic Controller) and the system is controlled by the supervisor systems through the FIX-DMACS software, where all necessary information are stored and then used and with said system monitoring the following parameters: Color, Coverage, Viscosity, Specific weight, Pressure, Flow, Dying power of the concentrated.

I summary, this process as the following characteristics: produces automatically the pain in the specified color and makes the automatic cleaning in approximately 3 minutes, in other words, all pipes, tanks, valves and equipment are totally clean in this short period of time and, with this, allows a fast changing of paint (changing the color and/or type of rosin) in respect to conventional methods used up

to now, with great flexibility in the production of paints, namely, it is possible to produce any color of paint in any rosin contained in the tanks of raw materials, without the smallest possibility of contamination of one paint with the other, with the whole color, coverage and viscosity control being performed on line.

For being continuous, the system has a flexibility to produce from small lots up to large ones.

It performs instantaneously the tests of color, solids, viscosity, specific weight along the whole manufacture process, with the tests being performed as the paint is produced. The time for the preparation of the system in order to produce a new lot is extraordinarily small in respect to the conventional process, due to the fact that the system performs the automatic cleaning.

With this system it is possible to achieve perfect reproductions of the paints, namely, the process produces always the same paint, as per the standards specified in the formulation.

Considering that this process is made in a continuous and automatic way, the adjustments are performed with the addition in the exact proportion, continuously, therefore eliminating the addition in larger quantities than the necessary ones and eliminating also eventual problems with the quality of the paint.

Due to the fact that the process is continuous and automatic, there is no need to obtain samples for the laboratory in a manual way, with all inconvenient mentioned above.

Another important benefit of being a continuous and automatic process is that it is possible to use the automation available resources, such as alarms, indication of instant reading, graphs of the parameters, reports, accrued values along the time, history, trends, etc., with the power to speed up and optimize the maintenance of the system providing events based in historic facts, filing problems or changes occurred in the system etc.

Great reliability of the measuring system, for this being a continuous and automatic system independent of outside variables, such as the waiting time to perform the tests, contamination, etc.

The system is possible to monitored, for all stages of the process and all parameters are duly known and controlled.

The system does not require the same number of operators for maintenance, nor the need of maintaining a laboratory with sophisticated equipment, for the controls are performed on line.

With this process, a great loss of time is avoided in the movement of raw materials for the addition of the products, as it is done in the conventional processes.

Due to the fact that the process is fully automatic, the personnel used in the operation of the plant becomes more specialized and therefore qualified to perform any repair in the plant.

For a better understanding of the object of this patent, we refer to the following drawings, where:

Figure 1 shows a diagram of the simplified flowchart for the process of loading the tanks with raw materials;

Figure 2 is a diagram of the simplified flowchart for the process of addition of rosins to the mixing tank identified by "A";

Figure 3 shows a diagram of a simplified flowchart of the addition process for additives in the mixing tank, identified by "B";

Figure 4 shows a diagram of a simplified flowchart of the addition process for dyes in the mixing tank, identified by "C";

Figure 5 shows a diagram of a simplified flowchart of the addition process for solvents in the mixing tank, identified by "D";

Figure 6 shows a diagram of a simplified flowchart of the addition process for small quantities of raw materials taken from the mixing tank, identified by "E";

Figure 7 shows a diagram of a simplified flowchart of the addition control system for several raw materials in to two mixing tanks, before being placed in the mixer, the system needed to obtain certain types of paints;

Figure 8 shows a diagram of a simplified flowchart of the reception process for raw materials in several tanks of the mixer, for the mixing, analysis of their characteristics and following to the packaging station;

Figure 9 shows a diagram of a simplified flowchart of the whole set, from the mixer to the later stor

Figure 10 shows a diagram of a simplified flowchart of the reception of nitrogen in the cleaning system, which pushes the paint present within the pipes and in the mixer;

Figure 11 shows a diagram of a simplified flowchart for the reception of clean solvent of the cleaning system; and

Figure 12 shows a diagram of a simplified flowchart for the taking out of dirty solvent from the cleaning system.

This Patent of Invention for a CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS constituted by several feeding lines of raw material, with such lines being basically formed by tanks (1) for the loading of raw materials which have the necessary stirrer motor (2) to homogenize said raw materials and the high level control (3) which, when the tank (1) reaches the required filling level, connects the high level transmitter which disconnects, automatically (through a software), the feeding pump (4) in order to stop the transfer of the raw material through the pipe (5) from the tank, bowl or other container (6) and controls the low level (7) which, when the tank is in its low level, connects the transmitter in order to turn the pump (4) on, which transfers through said pipe (5) the raw material from the tank (6) into the tank (1), pointing out that under normal conditions of operation, all raw materials connected to the production of a given paint are simultaneously and automatically added.

In the process for the addition of rosins (A), the recirculation of the rosin is started, namely, the rosin exists from one of the tanks (12a) with a stirrer (2a)

and through the pipe (8a) passes by a dosing pump (9a) which is automatically turned on when the system reaches a previously determined pressure, and by a duct (10a0) in order to communicate with the duct (11a) with a control valve (12a) and returning into the tank (1a) with the pressure of this first recirculation ring being controlled through the opening or closing of said control valve (12a) and, in this phase, the recirculation of the rosin is started in the second ring, which is formed by the pipe (13a), filter (14a), dosing pump (15a), flow meter (16a), diversive valve (17a) which returns the rosin by a pipe (18a) which, on its turn, is connected to the pipe (11a) and which, passing through the control valve (12a), returns to the tank (1a) or through the pipe (20a) going to the mixer (21); said dosing pump (15a) has a variable rotation allowing a variable flow to reach the specified quantity of rosin as per the respective paint formulas, with the quantity of rosin to be added in the mixer (21) being controlled by a flow meter (16a) which controls the rotation of the dosing pump (15a) which, as the total quantity of rosin determined for the production of the lot is introduced into the system, the adding pumps (9a and 16a) of the rosin tank will be turned off automatically.

In the process for the addition of dyes (B) which are stored on another tank (1b) with 20, 1.000 and 2,500 litters capacity and with a stirrer (2b), after being taken from the bowl (6b) by the feeding pump (4b) enters first into recirculation, coming out from the tank (1b), passing by the pipe (8b) and through the dosing pump (9b) which is automatically turned on when the system reaches a previously defined

pressure and by the pipe (10b) in order to connect with the pipe (11b) with the control valve (12b) in order to return to the tank (1b), with the pressure of this first ring being controlled through the opening or closing of the control valve (12b) and, in this phase, the recirculation of the concentrated in the second ring starts, which is formed by the pipe (13b), basket filter (14b), dosing pump (15b), flow meter (16b) and diversive valve (17b), which returns the concentrate by a duct (18b) which, on its turn, is connected with the pipe (11b) and which, passing by the control valve (12b) returns to the tank (1b) or through the pipe (20) goes to the mixer (21); said dosing pump (15b) has variable rotation allowing the variable flow in order to reach the quantity of concentrate specified in the respective formulas of paints. with the quantity of concentrate to be added in the mixer (21) being controlled by a flow meter (16b) which controls the rotation of the dosing pump (15b) and the quantity of concentrates which have to be introduced into the system controlled by the control loop which reads the color on-line and corrects instantaneously with the addition of concentrates inherent to the respective formula and, as the whole quantity of concentrate determined for the production of the lot is introduced into the system, the addition pumps (9b and 15b) of the dye tanks will be automatically turned off.

In the addition process for additives (C) which are stored in another tank (1c) of 20, 1,000 and 2,500 litters capacity and with motor stirrer (2c) which, after being taken from the bowl (6c) using a feeding pump (4c) enters initially in recirculation, namely, it exits the tank (1c), passes by the pipe (8c), by the dosing

pump (9c) which is automatically turned on when the system reaches a previously defined pressure and by a pipe (10c) in order to connect with the pipe (11c) with the control valve (12c) in order to return to the tank (1c), with the pressure of this first ring being controlled through the opening or closing of the control valve (12c) and, in this phase, the recirculation of the concentrated in the second ring starts, which is formed by the pipe (13c), basket filter (14c), dosing pump (15c), flow meter (16c) and diversive valve (17c), which returns the additives by a duct (18c) which, on its turn, is connected with the pipe (11c) and which, passing by the control valve (12c) returns to the tank (1c) or through the pipe (20) goes to the mixer (21); said dosing pump (15c) has variable rotation allowing the variable flow in order to reach the quantity of additives specified in the respective formulas of paints, with the quantity of additives to be added in the mixer (21) being controlled by a flow meter (16c) which controls the rotation of the dosing pump (15c) and the quantity of additives which have to be introduced into the system controlled by the control loop which reads the color on-line and corrects instantaneously with the addition of additives inherent to the respective formula and, as the whole quantity of additives determined for the production of the lot is introduced into the system, all addition pumps (9c and 15c) of the dye tanks will be automatically turned off.

In the addition process for additives (D) which are stored in another tank (1d) which is automatically loaded by PLC with the solvent coming out from the pipe (8d) being pumped, by the centrifuge dosing pump (9d), passing through the

basket filter (14d), by the flow meter (16d) and control valve (19d), until the pressure reaches a previously established value, with said pressure being adjusted until reaching a value programmed by the valve (12d) and then the valve (17d) which sends the flow through the pipe (18d) by the valve (12d) back to the tank (1d) and, upon changing the position (from ac to ab) and the solvent starts entering the mixer (21) and, in this stage, a fine adjustment of the flow will be made with the quantity of solvent being controlled by another flow meter (22) which sends instantaneously the viscosity value of the solvent to the program and this sends a signal to the control valve (19d) to open or close and, in this way, to control the viscosity specified in the formulation, in such a way that when the raw materials are finally introduced in said mixer (21), the whole lot of paint already established was produced with the system turning off automatically.

For the feeding of small quantities of raw materials (E) and for the adjustments of the mixer (21), a dispersion tank (2e) receives, through the pipe (5e) and the pump (4e) the raw material taken from the drum or bowl (6e).

Optionally, for the preparation of some types of paints, the process of the balanced mixture of raw materials may be divided into two feeding lines (F and G) which receive, alternately and independently, the introduction of the raw materials (221, 22b, 22c, 22d, 22e, 22f, ...), processed by pumps controlled by the PLC, through the on-off valves (23a, 23b, 23c, 23d, 23e, 23f, ...) and of rosin (24) through the valves (25a) and (25b), which shall be automatically dosed by the flow

meter (26) which are self adherent and the drains of which (27a), (27b), (28a) and (28b) serve to calibrate said meters (26) and filters (29a) and (29b) and through the pipes (30a) and (30b) and 3 way valves (31a) and (31b) which feed the mixing tanks (32a and 32b), not dedicated, each one with a motor stirrer (2), with said tanks having a lower outlet pipe through the gear pump (33a) and (33b) and flow meters (34a) and (34b) and two basket filters assembly in parallel (35a) and (35b) and connected in a 3 way valve (36a) and (36b) (which send the mixture to the main mixer (21) or which direct the mixture to 3 way valves (37a) and (37b) and to the pressure control valves (38a) and (38b) and bringing the mixture back to the mixing tanks (32a) and (32b) or, when the cleaning process, takes the dirty cleaning solvent to the outlet (39).

A semi-loading system may be placed in the two feeding lines (F and G) of the mixing tanks (32a and 32b), with such system being formed by drums, gear pumps and basket filter, where the quantity of raw materials manually measured through the weighing in scale with the raw materials being added in the mixing tanks (32a and 32b), through the pumping or manual unloading through the funnel installed in the mouth of the tanks.

The mixer (21) is a compact equipment and is provided with several independent inlet nozzles through which several raw materials are introduced within the inner mixing chamber, which has a defined minimum volume, necessary for a perfect homogenization of the raw materials, forming therefore the paint, with the

paint produced coming out through the pipe (40) and enters the storage tank (41), with part of the paint being formed in said mixer (21) going to the control cell. composed by diversive valves (42) and (43) by a small tank (44), a pump (45) and a colorimeter (46), where the color and coverage is analyzed, with the paint returning to the storage tank 941) through the pipe (47) and the data so obtained being then sent to the program which compares with the standard paint in order to add the necessary raw materials to adapt the color and coverage, until reaching the specified standards, with said program adding the flow meter (22) which reads the viscosity and sends the data to the program which, on its turn, compares with the viscosity specified and orders the addition or restriction of the quantity of solvent in order to adjust the viscosity which, if is out of the standards, will return to the tank (41) or if it has the standard viscosity and ready to be canned, the content of the storage tank (41) is unloaded through pipes by a pump (48) and valve (49) returning to the mixer (21) and from there through the flow meter (22) and, through pipes and the valve (50) and the discharge pipe (51) and discharging nozzles (52 and 53) may be packed in 0.9, 1.0, 3.6, 4.0, 200 litters or any other type of volume; after the end of the production of a given paint, the system is cleaned with solvent and dried with nitrogen automatically in 3 minutes, with the system remaining capable of producing a new lot of paint of any color or with any rosin.

In the start up process, the materials from all tanks (32a), (32b) of all rosin tanks (1a), of all dye tanks (1b), of all additive tanks (1c) and of all tanks of

solvents (1d) are pumped and remain recirculating in the pipe systems until the pressure reaching a stable value being, then, the dosing system and feeding system using the adjustment of the last lot produced; the first paint in the mixer (21) is taken to the storage tank (41) (called also lung tank) and, when the paint becomes stable within the technical specification, the flow is turned to the discharging of the ready paint (52 and 53) in drums or cans and, during the process, the material of the storage tank or lung tank 941) is gradually pumped into the mixer head (21) until the volume of said tank reaches the zero level, before the end of the "production run", totally controlled.

The feeding of new colors requires a 20 liter sample of the product, which is sent through the colorimeter (46) analyzers) using the small tank (44) and the pump (45) with the system registering the new color, with the product being then produced through the normal sequence using the percentile value of the inlet formula as a starting point and the color registrations and viscosity which intend to reach.

After the discharge being completed, a portion of nitrogen from the storage tank and distributed by the pipes passes through the diversive valve (54), is inserted through individual valves (55), (56), (57) and (58) in the points (59), (60), (61) and (62) of the system to push the product of the pipes in the outlet of the mixer (21) and in the pipes, the clean solvent is then introduced from the storage tank which passes through the pump (63), filter (64), and diversive valve (65) and is inserted

through the individual valves (66), (67), (68) and (69) in the points (70), (71), (72), (73) and (74), this last one passing through the pipe with the diversive valve (75) and passing into the mixing tanks (32a) and (32b), with the dirty solvent being taken out in the points (39) and (76) being placed within the storage tank (77) through the pump (78) taken for recuperation.

Periodically, the adjustment of the dosing pumps (15a), (15b), (15c), (9d), (33a) and (33b) in order to compensate the natural wear through a deviation of the outlets, using an hydraulic cylinder against a constant simulated pressures in the normal process; the time which the cylinder takes to run a given volume is measured and the flow x rotation curve stored in the control system are updated and, if the flow goes below a given value (maximum wear), the system informs the operator in order to process the change of said pumps (15a), (15b), (15c), (9d), (33a) and (33b).

CLAIMS

1. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS, characterized by several feeding lines of raw material, with such lines being formed basically by tanks (1) for the loading of raw materials, which have, if necessary, a motor stirrer (2) to homogenize said raw materials and high level control (3) which, when the tank (1) reaches the required filling level, turns the high level transmitter on which disconnects automatically (by software) the feeding pump (4) in order to stop the transfer, through the duct (5), the raw material of the tank, bowl or other (6) and a low level control (7) which, when the tank is with a low level turns said transmitter on to connect the pump (4) which transfer through said pipe (5) the raw material from the tank (6) into the tank (1),m pointing out that under normal conditions of operation, all raw materials inherent to the production of a given paint are added simultaneously and automatically.

2. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS as per the claim 1. characterized by the fact that in the process for addition of rosins (A) the recirculation of the rosin, namely, the rosin coming our of one of the tanks (1a) with motor stirrer (2) and through the duct (8a) passes by the dosing pump (a) which is automatically turned on when the system reaches a given pressure and by the pipe (10a) to connect the pipe (11a) with the control valve (12a) and returning to the tank (1a), with the pressure of this first recirculation ring being controlled through the

opening or closing of said control valve (12a) and, in this phase, the recirculation of the rosin begins in the second ring, which is formed by the pipe (13a), filter (14a), dosing pump (15a), flow meter (16a), diversive valve (17a), which returns the rosin through the pipe (18a) which is connected to the pipe (11a) and which, passing by the control valve (12a) returns to the tank (1a) or through the pipe (20a) going to the mixer (21); said dosing pump (15a) has variable rotation allowing a variable flow to reach the quantity or rosin specified in the respective formulas of the paints, with the quantity of rosin to be added in the mixer 921) controlled by a flow meter 916a) which commands the rotation of the dosing pump (15a) which as soon as all quantity of rosin determined for the production of the lot is introduced in the system, the addition pumps (9a and 16a) of the rosin tank will torn automatically off.

3. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS as per the claim 1, characterized by the fact that in the process for the addition of dyes (B) which are stored on another tank (1b) with 20, 1,000 and 2,500 litters capacity and with a stirrer (2b), after being taken from the bowl (6b) by the feeding pump (4b) enters first into recirculation, coming out from the tank (1b), passing by the pipe (8b) and through the dosing pump (9b) which is automatically turned on when the system reaches a previously defined pressure and by the pipe (10b) in order to connect with the pipe (11b) with the control valve (12b) in order to return to the tank (1b), with the pressure

of this first ring being controlled through the opening or closing of the control valve (12b) and, in this phase, the recirculation of the concentrated in the second ring starts, which is formed by the pipe (13b), basket filter (14b), dosing pump (15b), flow meter (16b) and diversive valve (17b), which returns the concentrate by a duct (18b) which, on its turn, is connected with the pipe (11b) and which, passing by the control valve (12b) returns to the tank (1b) or through the pipe (20) goes to the mixer (21); said dosing pump (15b) has variable rotation allowing the variable flow in order to reach he quantity of concentrate specified in the respective formulas of paints, with the quantity of concentrate to be added in the mixer (21) being controlled by a flow meter (16b) which controls the rotation of the dosing pump (15b) and the quantity of concentrates which have to be introduced into the system controlled by the control oop which reads the color on-line and corrects instantaneously with the addition of concentrates inherent to the respective formula and, as the whole quantity of concentrate determined for the production of the lot is introduced into the system, the addition pumps (9b and 15b) of the dye tanks will be automatically turned off.

4. **CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS** as per the claim 1, characterized by the fact that in the process for the addition of additives (C) which are stored in another tank (1c) of 20, 1,000 and 2,500 litters capacity and with motor stirrer (2c) which, after being taken from the bowl (6c) using a feeding pump (4c) enters initially in recirculation, namely, it exits the tank (1c), passes by the pipe (8c).

by the dosing pump (9c) which is automatically turned on when the system reaches a previously defined pressure and by a pipe (10c) in order to connect with the pipe (11c) with the control valve (12c) in order to return to the tank (1c), with the pressure of this first ring being controlled through the opening or closing of the control valve (12c) and, in this phase, the recirculation of the concentrated in the second ring starts, which is formed by the pipe (13c), basket filter (14c), dosing pump (15c), flow meter (16c) and diversive valve (17c), which returns the additives by a duct (18c) which, on its turn, is connected with the pipe (11c) and which, passing by the control valve (12c) returns to the tank (1c) or through the pipe (20) goes to the mixer (21); said dosing pump (15c) has variable rotation allowing the variable flow in order to reach the quantity of additives specified in the respective formulas of paints, with the quantity of additives to be added in the mixer (21) being controlled by a flow meter (16c) which controls the rotation of the dosing pump (15c) and the quantity of additives which have to be introduced into the system controlled by the control loop which reads the color on-line and corrects instantaneously with the addition of additives inherent to the respective formula and, as the whole quantity of additives determined for the production of the lot is introduced into the system, all addition pumps (9c and 15c) of the dye tanks will be automatically turned off.

5. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS as per the claim 1, characterized by the fact that in the process for the addition of solvents (D) used

to adjust the viscosity, the solvent, which comes from the tanks (1d) which is automatically loaded by PLC with the solvent coming out from the pipe (8d) being pumped, by the centrifuge dosing pump (9d), passing through the basket filter (14d), by the flow meter (16d) and control valve (19d), until the pressure reaches a previously established value, with said pressure being adjusted until reaching a value programmed by the valve (12d) and then the valve (17d) which sends the flow through the pipe (18d) by the valve (12d) back to the tank (1d) and, upon changing the position (from ac to ab) and the solvent starts entering the mixer (21) and, in this stage, a fine adjustment of the flow will be made with the quantity of solvent being controlled by another flow meter (22) which sends instantaneously the viscosity value of the solvent to the program and this sends a signal to the control valve (19d) to open or close and, in this way, to control the viscosity specified in the formulation, in such a way that when the raw materials are finally introduced in said mixer (21), the whole lot of paint already established was produced with the system turning off automatically.

6. **CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS** as per the claim 1, characterized by the fact for the feeding of small quantities of raw material (E) and for the adjustment of the mixer (21), a dispersion tank (1e) receives, through the pipe (5e) and pump (4e) the raw material taken from the bowl or container (6e).

7. **CONTINUOUS AND AUTOMATIC PROCESS FOR THE**

PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS as per the claim 1. characterized by the fact that, optionally, for the preparation of some types of paints. the process of the balanced mixture of raw materials may be divided into two feeding lines (F and G) which receive, alternately and independently, the introduction of the raw materials (22l, 22b, 22c, 22d, 22e, 22f, ...), processed by pumps controlled by the PLC, through the on-off valves (23a, 23b, 23c, 23d, 23e, 23f, ...) and of rosin (24) through the valves (25a) and (25b), which shall be automatically dosed by the flow meter (26) which are self adherent and the drains of which (27a), (27b), (28a) and (28b) serve to calibrate said meters (26) and filters (29a) and (29b) and through the pipes (30a) and (30b) and 3 way valves (31a) and (31b) which feed the mixing tanks (32a and 32b), not dedicated, each one with a motor stirrer (2), with said tanks having a lower outlet pipe through the gear pump (33a) and (33b) and flow meters (34a) and (34b) and two basket filters assembly in parallel (35a) and (35b) and connected in a 3 way valve (36a) and (36b) (which send the mixture to the main mixer (21) or which direct the mixture to 3 way valves (37a) and (37b) and to the pressure control valves (38a) and (38b) and bringing the mixture back to the mixing tanks (32a) and (32b) or, when the cleaning process, takes the dirty cleaning solvent to the outlet (39).

8. **CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS** as per the claim 7. characterized by a semi-loading system that may be placed on the two feeding lines

(F and G) of the mixing tanks (32a and 32b), with such system being formed by drums, gear pump and basket filter, where the quantity of raw material is measured manually through the weighing in scale, with the raw materials being added in the mixing tanks (32a and 32b) through the pumping or manual discharge, through a funnel installed in the nozzle of the tanks.

9. **CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS** as per the claims 2, 3, 4, 5, 6, and 7, characterized by the fact that said mixer (21) is a mixer compact with several independent inlet nozzles through which the raw materials are introduced in the inner mixing chamber, which has a defined minimum volume, necessary for a perfect homogenization of the raw materials, forming the paint, with the produced paint coming out from the pipe (40) and entering into the storing tank (41), with part of the paint being formed in said mixer (21) going to the control cell, composed by diversive valves (42) and (43) by a small tank (44), a pump (45) and a colorimeter (46), where the color and coverage is analyzed, with the paint returning to the storage tank 941) through the pipe (47) and the data so obtained being then sent to the program which compares with the standard paint in order to add the necessary raw materials to adapt the color and coverage, until reaching the specified standards, with said program adding the flow meter (22) which reads the viscosity and sends the data to the program which, on its turn, compares with the viscosity specified and orders the addition or restriction of the quantity of solvent in order to adjust the

viscosity which, if is out of the standards, will return to the tank (41) or if it has the standard viscosity and ready to be canned, the content of the storage tank (41) is unloaded through pipes by a pump (48) and valve (49) returning to the mixer (21) and from there through the flow meter (22) and, through pipes and the valve (50) and the discharge pipe (51) and discharging nozzles (52 and 53) may be packed in 0.9, 1.0, 3.6, 4.0, 200 litters or any other type of volume; after the end of the production of a given paint, the system is cleaned with solvent and dried with nitrogen automatically in 3 minutes, with the system remaining capable of producing a new lot of paint of any color or with any rosin.

10. **CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS** characterized by the fact that in the start up process, the materials from all tanks (32a), (32b) of all rosin tanks (1a), of all dye tanks (1b), of all additive tanks (1c) and of all tanks of solvents (1d) are pumped and remain recirculating in the pipe systems until the pressure reaching a stable value being, then, the dosing system and feeding system using the adjustment of the last lot produced; the first paint in the mixer (21) is taken to the storage tank (41) (called also lung tank) and, when the paint becomes stable within the technical specification, the flow is turned to the discharging of the ready paint (52 and 53) in drums or cans and, during the process, the material of the storage tank or lung tank 941) is gradually pumped into the mixer head (21) until the volume of said tank reaches the zero level, before the end of the "production run", totally

controlled.

11. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS characterized by the alignment of new colors requiring a 20 litter sample of the product, which is sent through the colorimeter (46) analyzers) using the small tank (44) and the pump (45), with the system registering the new color, with the product being then produced by a normal sequence using the percentile value of the inlet formula as the starting point and the registration of color and viscosity which we intend to reach.

12. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS characterized by the fact that after the discharge being completed, a portion of nitrogen from the storage tank and distributed by the pipes passes through the diversive valve (54), is inserted through individual valves (55), (56), (57) and (58) in the points (59), (60), 61) and (62) of the system to push the product of the pipes in the outlet of the mixer (21) and in the pipes, the clean solvent is then introduced from the storage tank which passes through the pump (63), filter (64), and diversive valve (65) and is inserted through the individual valves (66), (67), (68) and (69) in the points (70), (71), (72), (73) and (74), this last one passing through the pipe with the diversive valve (75) and passing into the mixing tanks (32a) and (32b), with the dirty solvent being taken out in the points (39) and (76) being placed within the storage tank (77) through the pump (78) taken for recuperation.

13. CONTINUOUS AND AUTOMATIC PROCESS FOR THE PRODUCTION OF AUTOMOTIVE AND OTHER PAINTS characterized by the fact that it is necessary to adjust, periodically, the dosing pumps (15a). (15b). (15c). (9d). (33a) and (33b) in order to compensate the natural wear through a deviation of the outlets. using an hydraulic cylinder against a constant simulated pressures in the normal process; the time which the cylinder takes to run a given volume is measured and the flow x rotation curve stored in the control system are updated and. if the flow goes below a given value (maximum wear). the system informs the operator in order to process the change of said pumps (15a). (15b). (15c). (9d). (33a) and (33b).

FIG. 1

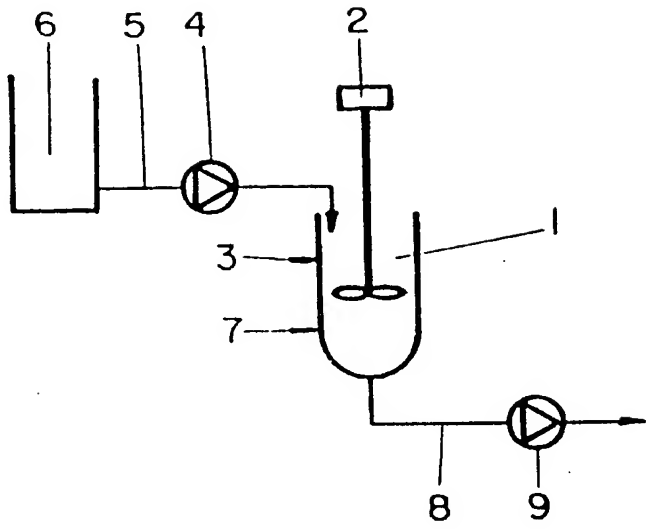


FIG. 2

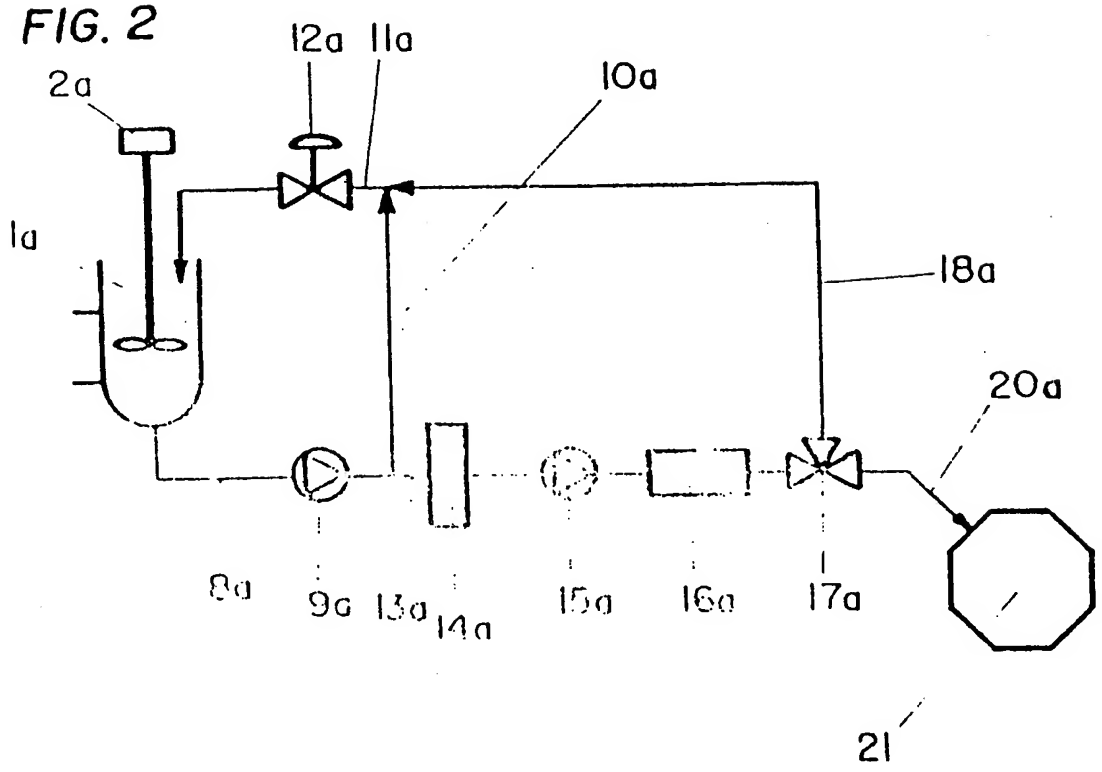
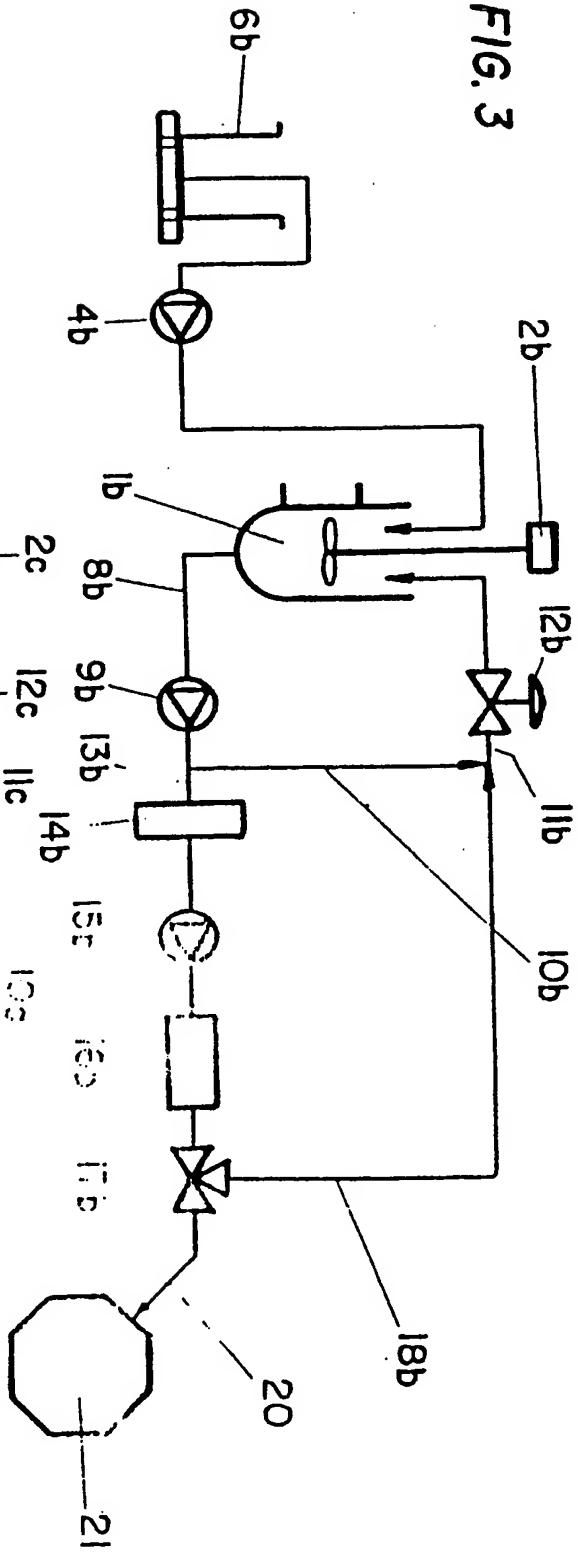


FIG. 3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18b
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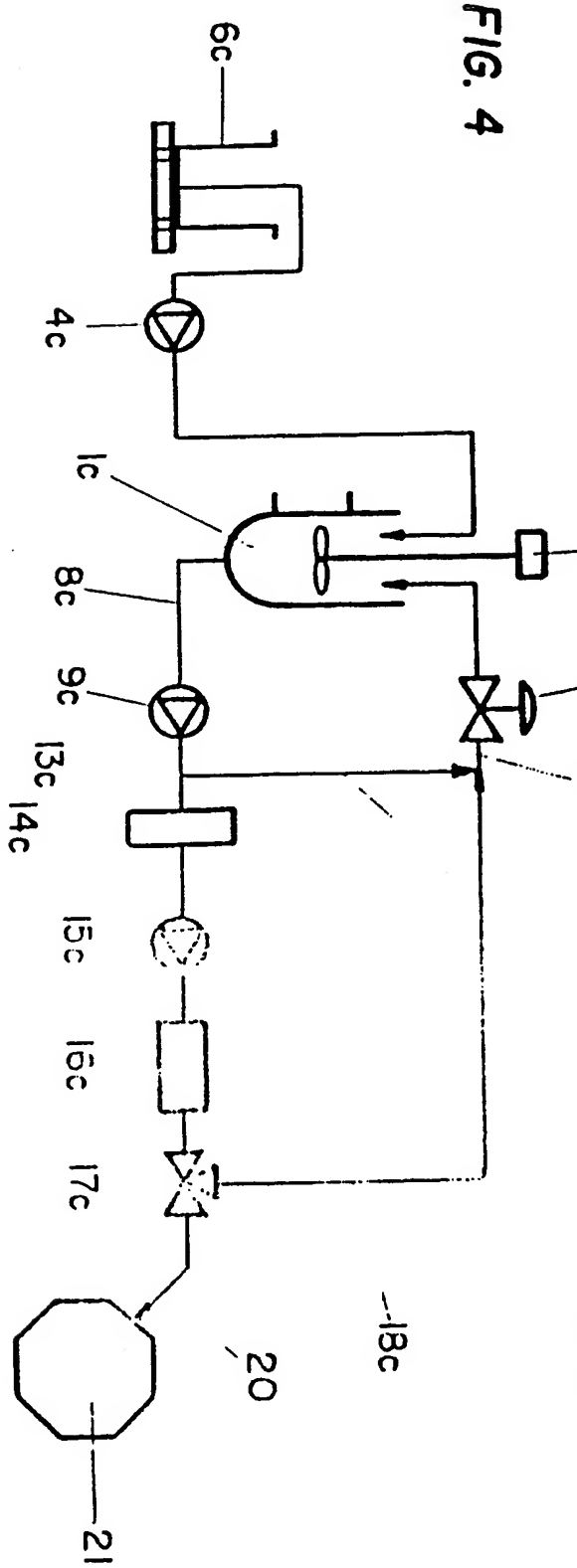
21

FIG. 4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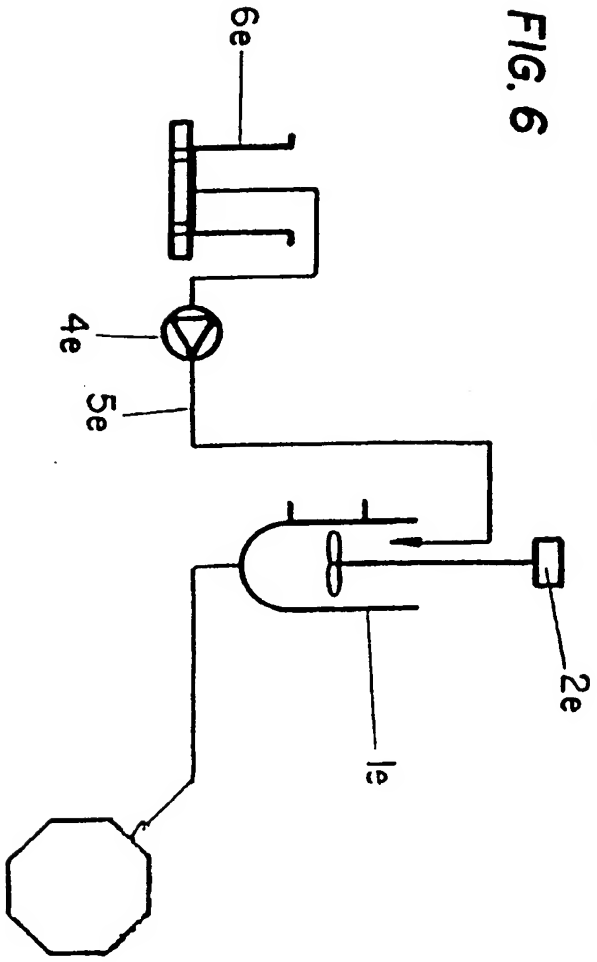

FIG. 6

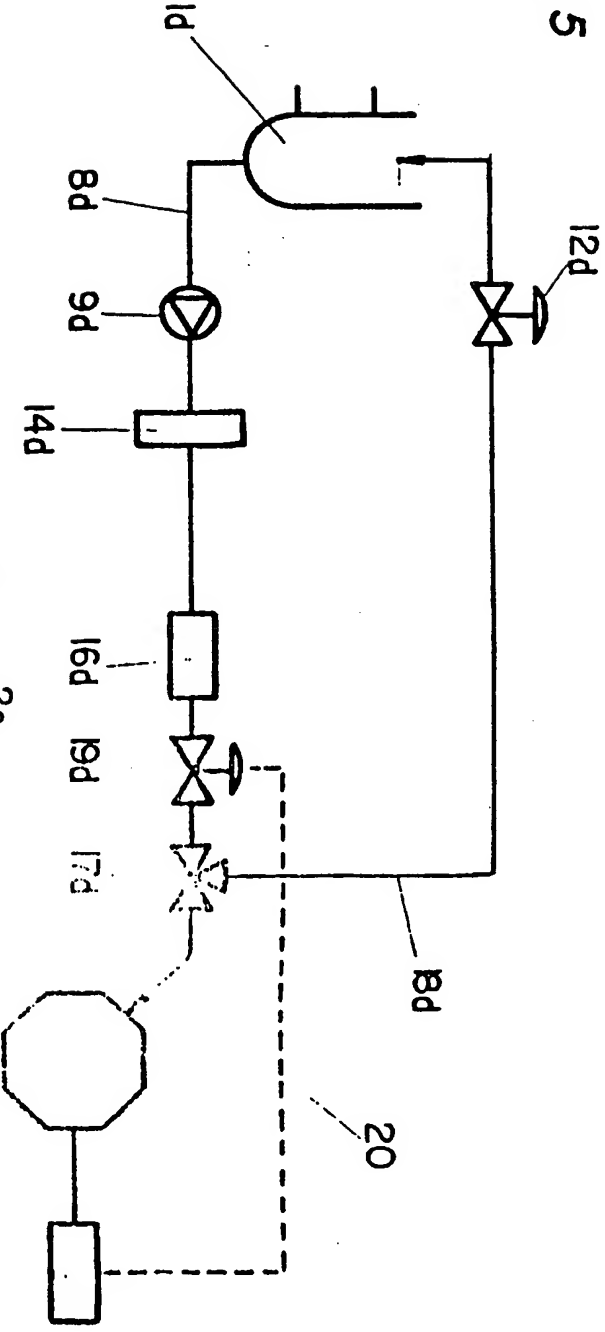

FIG. 5

FIG.7

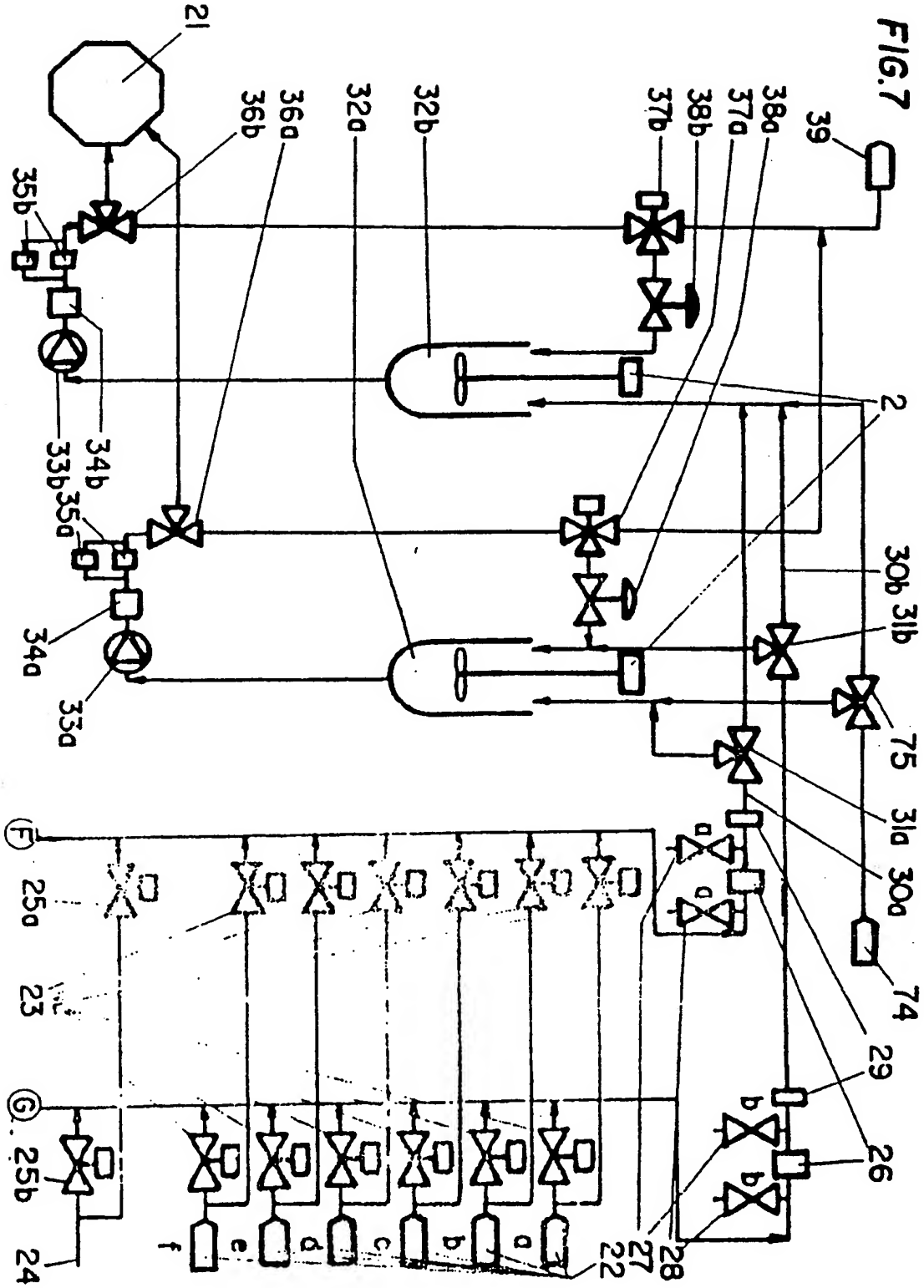
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FIG. 8

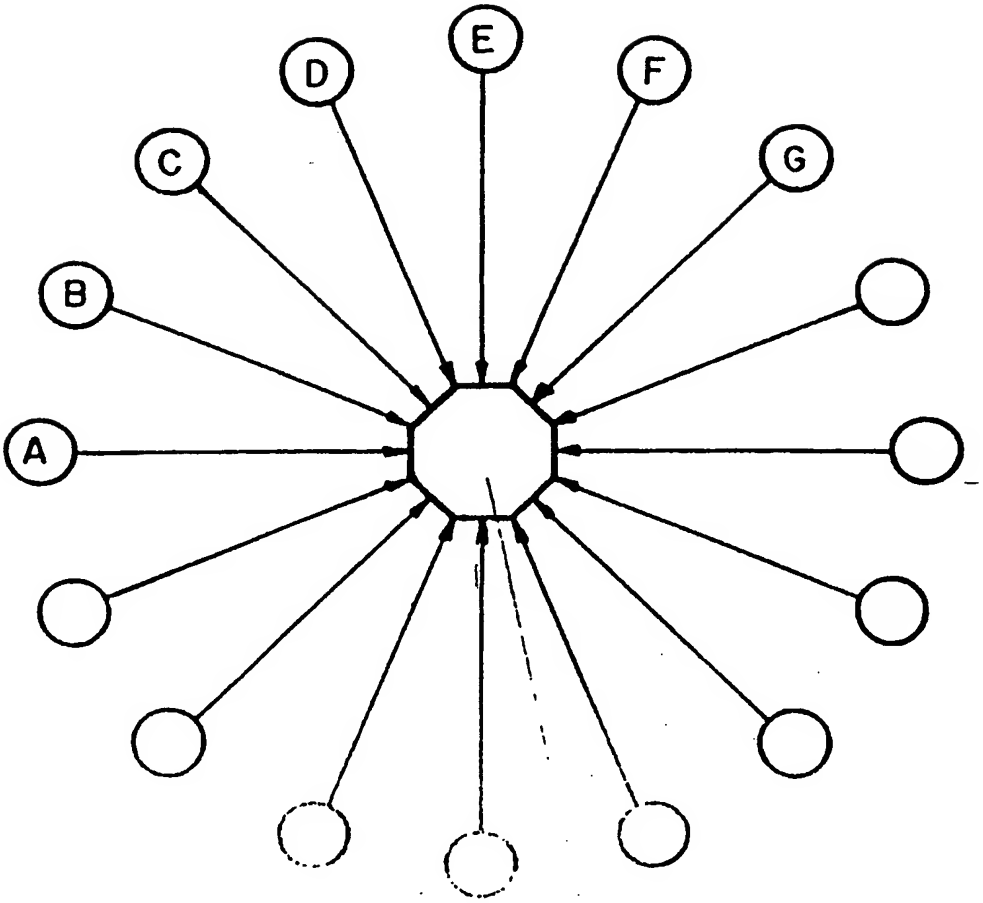

FIG. 9

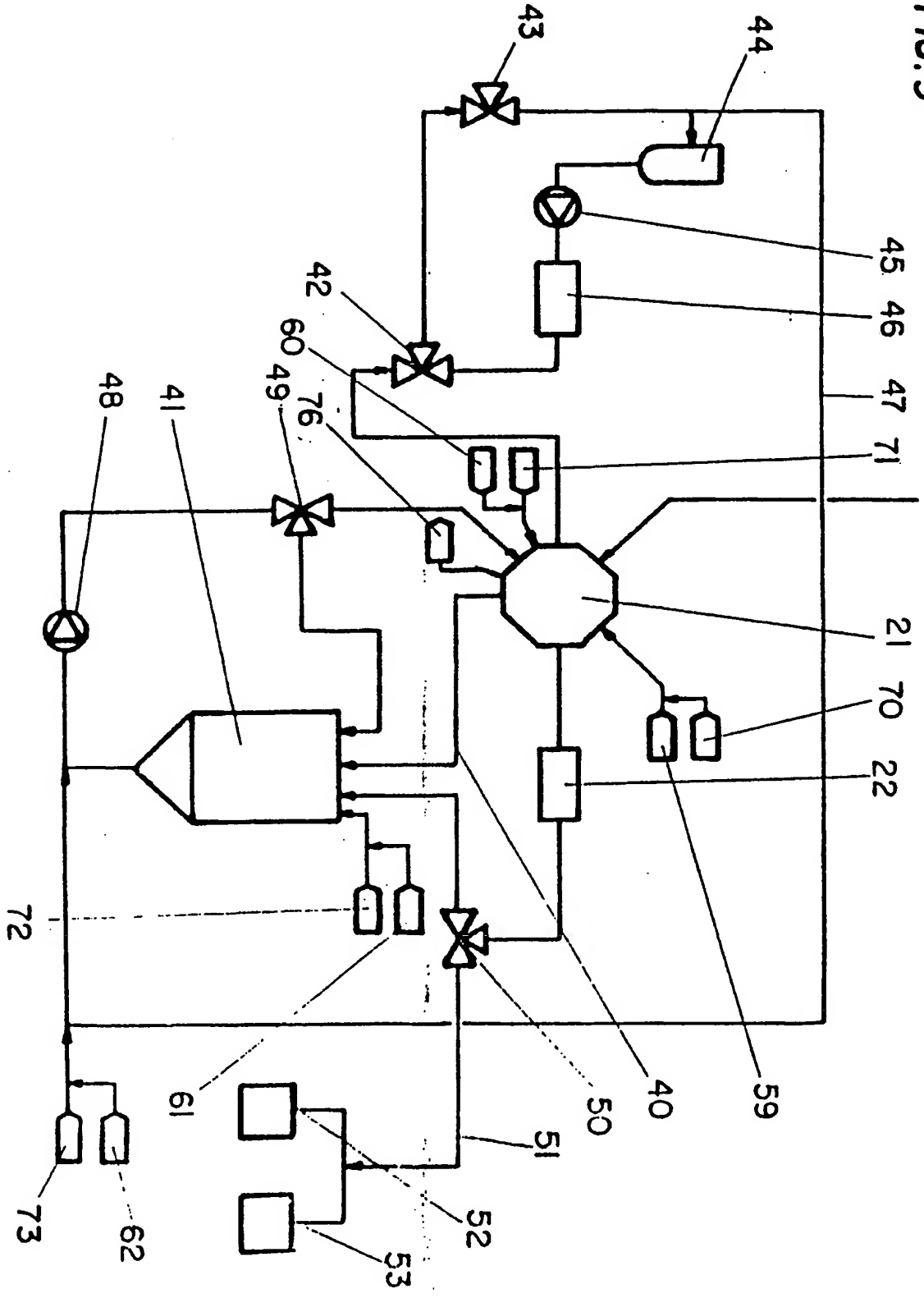
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FIG. 10

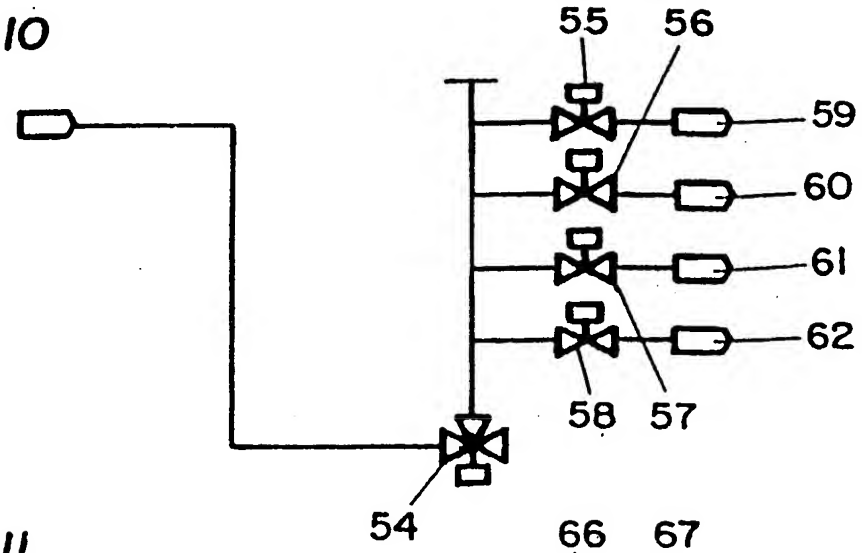


FIG. 11

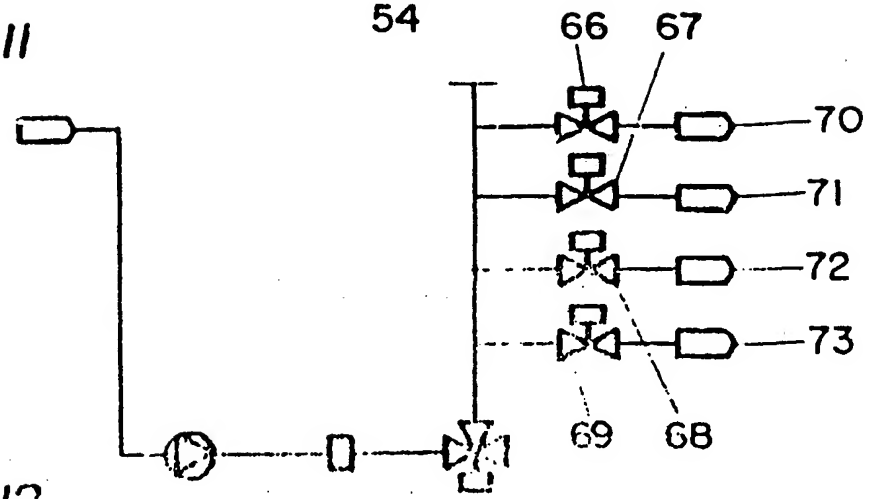
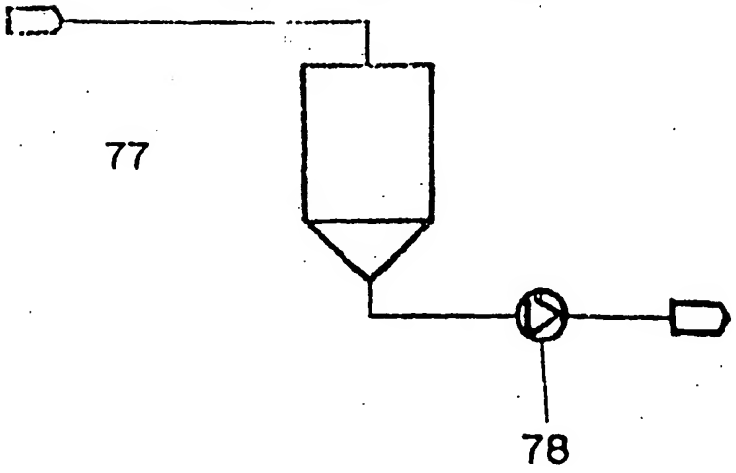


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/BR98/00099

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B01F 15/02
US CL :366/132, 134, 136, 138, 140, 152.1, 153.1, 160.3
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 366/131, 132, 134, 136, 137, 138, 140, 141, 142, 151.1, 152.1, 152.6, 153.1, 159.1, 160.1, 160.2, 160.3, 162.1, 348, 605

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,403,866 A (FALCOFF ET AL.) 13 September 1983, see entire document.	11
A	US 3,830,473 A (LIEFERMAN ET AL.) 20 August 1974, see Figure 1.	1-8
A	US 5,590,960 A (CLINTON ET AL.) 07 January 1997, see Figures 1-2.	1-8
A	US 3,425,667 A (SCHUTTE ET AL.) 04 February 1969, see Figure 1.	1-8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

30 APRIL 1999

Date of mailing of the international search report

19 MAY 1999

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